SGVU J CLIM CHANGE WATER
Vol. 1(1), Jan 2014 pp 62-64
ISSN: 2347-7741

SOLAR DISTILLATION TECHNIQUES FOR WASTE WATER UTILIZATION

ABHISHEK SINGH*
Research Scholar, Suresh Gyan Vihar University, Jaipur, Rajasthan
**Corresponding Author, e-mail: er.singhabhishek28@gmail.com*

Abstract - Today's the major problem for world is shortage of good, pure drinking water. In most cases, ponds, streams, wells and rivers are often polluted that they are unsafe for direct use as drinking water. Often water sources are brackish and or contain harmful bacteria. Therefore cannot be used for drinking. Solar distillation is one of the important methods of utilizing solar energy for the supply of potable water to small communities where natural supply of fresh water is inadequate or of poor quality. In solar distillation water is evaporated; using the energy of the sun then the vapour condenses as pure water. This process removes salts and other impurities. Solar energy is allowed into the collector to heat the water. The water evaporates only to condense on the underside of the glass. When water evaporates, only the water vapor rises, leaving contaminants behind. The gentle slope of the glass directs the condensate to a collection trough, which in turn delivers the water to the collection bottle

Keywords - Solar Distillation, Solar Still, Water Collector, Productivity, Borewell Water, River water, Sea Water, Potable Water.

INTRODUCTION

There is an important need for clean, pure drinking water in many developing countries. Often water sources are brackish (i.e. contain dissolved salts) and/or contain harmful bacteria and therefore cannot be used for drinking. In addition, there are many coastal locations where water is abundant but potable water is not available. Pure water is also useful for batteries and in hospitals or schools. Distillation is one of many processes that can be used for water purification. This requires an energy input, as heat, solar radiation can be the source of energy. In this process, water is evaporated, thus separating water vapour from dissolved matter, which is condensed as pure water.

A solar distillation system was built and tested to study the effect of increasing the solar radiation incident on a roof-type still, which was also augmented with a flat-plate collector. The modification was performed by adding a reflective surface to a structure that was already used to carry the hot and cold water tanks which were parts of the solar water heating system. The reflective surface was designed to reflect mid-day solar radiation on a single stage. The surface was fixed on one side of the water tank, and the relative position of the tank and the still has been modified to maximize the radiation reflected by the reflecting surface on the surface of the still.

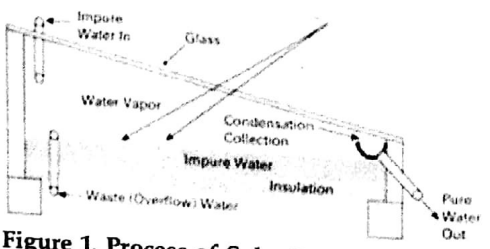

Figure 1. Process of Solar Distillation Through Solar Still

The basic principles of solar water distillation are simple, yet effective, as distillation replicates the way nature makes rain. The sun's energy heats water to the point of evaporation. As the water evaporates, water vapour rises, condensing

on the glass surface for collection. This process removes impurities, such as salts and heavy metals, and eliminates microbiological organisms. The end result is water cleaner than the purest rainwater.

BASIC PRINCIPLE

The basic concept of solar distillation is to convert impure and salty water suitable for drinking. Generally the water in the open container is evaporated in the air. So the purpose of this Solar still is to capture the evaporated air and condensed it onto a cool surface for further utilization of the collected water. There are mainly two processes which are involved in the distillation process, they are evaporation and condensation. During the evaporation process, the contaminated water are being heated by solar radiation and these water vapour is being collected onto a cold surface for the further process of condensation. The rate of evaporation can be accelerated by increasing the water temperature and area of water in contact with air.

Furthermore, the rate of evaporation is increased by painting the body of water container black, which is a good absorber of heat and solar radiation. After the process of evaporation, the water vapour is condensed onto cold surface so that water after condensing can be collected in container in the form of water droplet. This water droplet which is collected is the pure water. In solar still the container is covered by either a glass film or a plastic cover, so that container can easily collect the water after the processes. The process is defined clearly in figure 2.

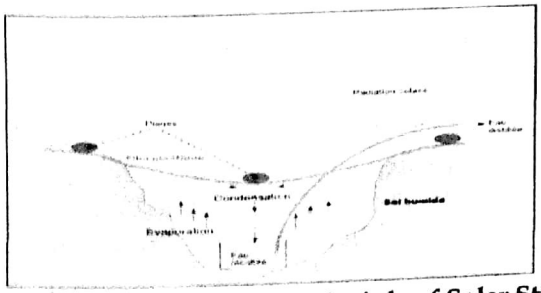

Figure 2. Showing Basic Principle of Solar Still

METHODOLOGY

There are various devices or methods which are used for improvement of waste water, which are as follows:

- Filtration
- Simple Distillation
- Chlorination of impure water
- Solar Distillation by Solar Still
- Removal of dissolved material

SOLAR STILL

Single-basin stills have been much studied and their behaviour is well understood. The efficiency of solar stills which are well-constructed and maintained is about 50% although typical efficiencies can be 25%. Daily output as a function of solar irradiation is greatest in the early evening when the feed water is still hot but when outside temperatures are falling. At very high air temperatures such as over 45°C, the plate can become too warm and condensation on it can become problematic, leading to loss of efficiency

Some problems with solar stills which would reduce their efficiency include:

- Poor fitting and joints, which increase colder air flow from outside into the still Cracking, breakage or scratches on glass, which reduce solar transmission
- Growth of algae and deposition of dust, bird droppings, etc. To avoid this still need to be cleaned regularly every few days
- Damage over time to the blackened absorbing surface.
- Accumulation of salt on the bottom, which needs to be removed periodically
- The saline water in the still is too deep, or dries out. The depth needs to be maintained at around 20mm.

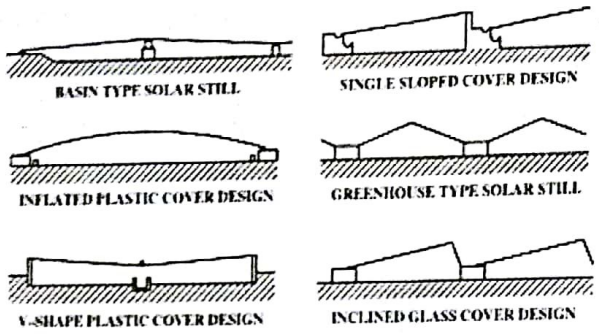

Figure 3. Simple Types of Solar Still

The cover can be either glass or plastic. Glass is preferable to plastic because most plastic degrades in the long term due to ultra violet light from sunlight and because it is more difficult for water to condense onto it. Tempered low-iron glass is the best material to use because it is highly transparent and not easily damaged. However, if this is too expensive to run available, normal window glass can be used.

ADVANTAGE OF SOLAR DISTILLATION

- Free of charge sun energy (during sunlight it eliminates 500 Watt electric consumption per one hour of sunlight)
- There are no moving parts; it is therefore reliable and almost maintenance free (cleaning is required though)
- Water taste is claimed to be better since the device act as a Solar Water Vapourizer and it doesn't boil the water (resembling rain water)
- Neutral pH is claimed (like rainwater), not like the not neutral pH of steamed distilled water

DISADVANTAGE OF SOLAR DISTILLATION

- Solar distillers don't kill bacteria and they don't break down harmful chemicals because they don't boil the water
- The large area tilted glass cover might be an attraction to bugs and insects
- Low production capacity, not enough for the drinking water needs of the average family

CONCLUSION

1. From the above discussion , it is cleared that the solar distillation plants are relatively inexpensive low temperature technology system, and would be one of the best solutions to supply fresh drinking water to small isolated communities with no technical facilities
2. Solar still is used provide good quality of water from source of poor quality water.
3. The amount of water collected is totally dependent over the peak temperature and the length of duration of temperature of water basin.
4. The maximum water is collected through the solar still is during bright sunny day, when the solar radiation is maximum.
5. Solar still is affected by the poor weather, cloudy day, so it is totally dependent over the climate.
6. Since it is cheap and easy technique, but it's efficiency is very less.

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